

Structure for a 90mm Nb₃Sn Cosine-2 Theta IR Quadrupole Magnet

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Abstract

A full-scale mechanical model of a Nb₃Sn quadrupole magnet loading structure has been designed, built and tested. The structure will support a 90mm bore, 1-meter long magnet prototype as part of the US LHC Accelerator Research Program (LARP). The structure utilizes Bladder and Key Technology to precisely control and transfer pre-stress from an outer aluminum shell and iron yoke structure to an inner coil. The outer aluminum shell and an inner “dummy coil” (a machined aluminum tube) were extensively instrumented with strain gauges. The gauges were used to monitor and map the effectiveness of the stress interactions between structure and coil through varying mechanical load conditions – from bladder and key pre-stress at room temperature through cool-down. Assembly techniques and design are discussed. Test results of the stress distributions in the structure and the “dummy coil” are reported and compared with predicted results calculated with the structural analysis program ANSYS.

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